National Transportation Safety Board
Aviation Accident Final Report

Location:	SALINAS, CA	**Accident Number:**	LAX94LA054
Date & Time:	11/20/1993, 0845 PST	**Registration:**	N161HA
Aircraft:	HILLER UH-12E	**Aircraft Damage:**	Substantial
Defining Event:		**Injuries:**	1 Minor
Flight Conducted Under:	Part 137: Agricultural		

Analysis

DURING A SWATH RUN TO APPLY A MIXTURE OF PESTICIDES, THE PILOT HEARD A LOUD 'POP'. THE HELICOPTER'S COLLECTIVE CONTROL BEGAN TO OSCILLATE AND THE AIRCRAFT EXPERIENCED A SEVERE VIBRATION. THE HELICOPTER ALSO BEGAN TO OSCILLATE AND THE PILOT SLOWED TO ABOUT 15 KNOTS AND ATTEMPTED TO LAND. A SPRAY BOOM ATTACHED TO THE HELICOPTER CONTACTED THE GROUND AND THE HELICOPTER ROLLED ON ITS LEFT SIDE. EXAMINATION REVEALED THE PRESENCE OF FRETTING CORROSION AND A FATIGUE FAILURE OF THE TENSION-TORSION BAR PIN, INTO WHICH THE MAIN ROTOR BLADE DRAG BRACE IS ATTACHED. A SECOND TENSION-TORSION PIN FROM A SISTER HELICOPTER WAS DISCOVERED TO ALSO HAVE CORROSION AND A FATIGUE CRACK. PINS FAILED AT 369.5 HOURS AND 489.4 HOURS RESPECTIVELY. THE RETIREMENT LIFE OF THE PIN IS 643 HOURS.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: a fatigue failure of the torsion-tension bar pin due to fretting corrosion. A factor in this accident was an inadequate quality of material utilized in the manufacture of the pin.

Findings

Occurrence #1: AIRFRAME/COMPONENT/SYSTEM FAILURE/MALFUNCTION
Phase of Operation: MANEUVERING - AERIAL APPLICATION

Findings
1. (C) ROTOR SYSTEM,MAIN ROTOR BLADE DRAG BRACE - CORRODED
2. (C) ROTOR SYSTEM,MAIN ROTOR BLADE DRAG BRACE - FATIGUE
3. (F) MATERIAL DEFECT(INADEQUATE QUALITY OF MATERIAL) - MANUFACTURER

Occurrence #2: LOSS OF CONTROL - IN FLIGHT
Phase of Operation: MANEUVERING - AERIAL APPLICATION

Findings
4. DIRECTIONAL CONTROL - NOT POSSIBLE - PILOT IN COMMAND

Occurrence #3: IN FLIGHT COLLISION WITH TERRAIN/WATER
Phase of Operation: DESCENT - EMERGENCY

Findings
5. TERRAIN CONDITION - CROP

Factual Information

On November 20, 1993, about 0845 hours Pacific standard time, a Hiller UH-12E helicopter, N161HA, crashed during an emergency landing about 8 miles southeast of Salinas, California. The helicopter was being operated as a visual flight rules (VFR) aerial application flight in the local area under Title 14 CFR Part 137 when the accident occurred. The helicopter, operated by R and B Helicopters Inc., sustained substantial damage. The certificated commercial pilot, the sole occupant, received minor injuries. Visual meteorological conditions prevailed. The flight originated from an adjacent field at about 0844 hours.

The pilot reported that while on a swath run to apply a mixture of pesticide about 2 feet above a field, he heard a loud "pop". The helicopter's collective control began to oscillate and the aircraft experienced a severe vibration. The helicopter also began to oscillate, and the pilot slowed to about 15 knots and attempted to land. A spray boom contacted the ground and the helicopter rolled onto its left side.

The pilot reported that the outboard end of one-of-two tension-torsion bar pins separated at the eye bolt end. This allowed the main rotor blade drag brace fitting to pull out of the tension-torsion pin, permitting the main rotor blade to rotate freely on the blade hub.

The helicopter had accumulated a total time in service of 7,725.3 flight hours. The most recent annual inspection was accomplished on November 1, 1992, 772.8 flight hours before the accident. In addition, a 100-hour inspection was completed on October 14, 1993, 73.5 hours before the accident.

The tension-torsion bar pin, part number 51452, serial number 26536, has a retirement life of 643 hours. The pin had a new serviceable part tag from the manufacturer that was dated April 29, 1993. The pin was installed on the accident helicopter by the operator on June 1, 1993. It had accumulated 369.5 hours before the accident. As a result of Air Worthiness Directive 86-17-2, dated August 22, 1986, the pin is subject to a recurring 100-hour inspection that includes a dye penetrant examination.

The tension-torsion pins are also subject to Rogerson Hiller Inc. Service Bulletins 51-2 and 51-9. Bulletin 51-2, dated March 31, 1978, addresses proper alignment between the tension-torsion pin and the main rotor blade drag brace fitting to preclude an imposition of large twisting moments on the head of the pin. An assessment of any drag brace misalignment, limited to 1/16 of an inch, is included in each 100-hour inspection.

Bulletin 51-9, dated April 8, 1983, addresses the addition of shims between the tension-torsion pin and the drag brace fitting to reduce fretting corrosion. Compliance with the service bulletin is not mandatory; however, if performed, a logbook entry is required. Repeated examinations of the shims were not required. The operator reported that the service bulletin was not performed.

The operator reported that he examined a second company helicopter, N5374V, also a Hiller UH-12E, on December 1, 1993. During a dye penetrant inspection of the tension-torsion bar pins, a crack was discovered in the interior radius of the eye bolt of one of the two pins. The pins were included as part of a complete rotor head assembly that had a part tag dated March 3, 1993. The rotor head assembly was part number 51439-19, serial number 10529-A. The head assembly was installed on N5374V by the operator on March 27, 1993. The pins did not have individual component record cards and were either serial number 46168 or 46169. The

rotor head assembly had accrued a total time in service of 489.4 hours.

The separated tension-torsion bar pin from N161HA, and the cracked pin from N5374V are manufactured from AN 4140 steel and coated with cadmium. The pins were submitted to the National Transportation Safety Board, Materials Laboratory for examination. The separated pin from the accident aircraft bolt through-hole contained areas of high luster indicative of wear from the pin moving relative to the retaining bolt. The fracture surface exhibited beach marks typical of a fatigue crack. The crack emanated from multiple origin areas on the inside radius of the bolt through-hole. The surface area of the fatigue origin area exhibited corrosion pits. The pits contained deposits of cadmium and sulphur. The cadmium coating at the fatigue origin area was not present on the inside diameter surface.

A magnetic particle inspection of the cracked tension-torsion bar pin from N5374V revealed that the crack emanated from the inside diameter of the bolt through-hole and traversed about 80 percent of the bolt sidewall. Opening of the fracture surface revealed beach marks typical of a fatigue crack originating from multiple origins on the inside radius of the bolt through-hole. The surface area of the fatigue origin area exhibited corrosion pits. The pits also contained deposits of cadmium and sulphur.

Pilot Information

Certificate:	Flight Instructor; Commercial	**Age:**	51, Male
Airplane Rating(s):	Multi-engine Land; Single-engine Land	**Seat Occupied:**	Center
Other Aircraft Rating(s):	Helicopter	**Restraint Used:**	Seatbelt, Shoulder harness
Instrument Rating(s):	Airplane; Helicopter	**Second Pilot Present:**	No
Instructor Rating(s):	Airplane Multi-engine; Airplane Single-engine; Helicopter; Instrument Airplane; Instrument Helicopter	**Toxicology Performed:**	No
Medical Certification:	Class 2 Valid Medical--no waivers/lim.	**Last FAA Medical Exam:**	06/01/1993
Occupational Pilot:		**Last Flight Review or Equivalent:**	
Flight Time:	17376 hours (Total, all aircraft), 10000 hours (Total, this make and model), 17015 hours (Pilot In Command, all aircraft), 194 hours (Last 90 days, all aircraft), 65 hours (Last 30 days, all aircraft), 5 hours (Last 24 hours, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	HILLER	**Registration:**	N161HA
Model/Series:	UH-12E UH-12E	**Aircraft Category:**	Helicopter
Year of Manufacture:		**Amateur Built:**	No
Airworthiness Certificate:	Restricted	**Serial Number:**	HA-3061
Landing Gear Type:	Skid	**Seats:**	3
Date/Type of Last Inspection:	10/14/1993, 100 Hour	**Certified Max Gross Wt.:**	3100 lbs
Time Since Last Inspection:	74 Hours	**Engines:**	1 Turbo Shaft
Airframe Total Time:	7725 Hours	**Engine Manufacturer:**	ALLISON
ELT:	Not installed	**Engine Model/Series:**	250-C20
Registered Owner:	R AND B HELICOPTERS	**Rated Power:**	400 hp
Operator:	R AND B HELICOPTERS	**Operating Certificate(s) Held:**	
Operator Does Business As:		**Operator Designator Code:**	CBFG

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual Conditions	**Condition of Light:**	Day
Observation Facility, Elevation:	SNS, 84 ft msl	**Distance from Accident Site:**	8 Nautical Miles
Observation Time:	0815 PST	**Direction from Accident Site:**	315°
Lowest Cloud Condition:	Unknown / 20000 ft agl	**Visibility**	35 Miles
Lowest Ceiling:	Overcast / 20000 ft agl	**Visibility (RVR):**	0 ft
Wind Speed/Gusts:	10 knots /	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	120°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	30 inches Hg	**Temperature/Dew Point:**	9°C / 2°C
Precipitation and Obscuration:			
Departure Point:		**Type of Flight Plan Filed:**	None
Destination:		**Type of Clearance:**	None
Departure Time:	0844 PST	**Type of Airspace:**	Class G

Wreckage and Impact Information

Crew Injuries:	1 Minor	**Aircraft Damage:**	Substantial
Passenger Injuries:	N/A	**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	1 Minor	**Latitude, Longitude:**	

Administrative Information

Investigator In Charge (IIC):	SCOTT R ERICKSON,	**Report Date:**	09/13/1994
Additional Participating Persons:	ROGER SIGG; SAN JOSE, CA		
Publish Date:			
Investigation Docket:	NTSB accident and incident dockets serve as permanent archival information for the NTSB's investigations. Dockets released prior to June 1, 2009 are publicly available from the NTSB's Record Management Division at pubinq@ntsb.gov, or at 800-877-6799. Dockets released after this date are available at http://dms.ntsb.gov/pubdms/.		

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